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328. Proposed by W. J. GREENSTREET, M. A., Marling School, Stroud, England.

If  $x^2 + xy + y^2 = 3a^2$ , find the maximum value of  $bx + cy$ .

Solution by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa., and J. SCHEFFER, A. M., Hagerstown, Md.

$$x^2 + xy + y^2 = 3a^2, \quad bx + cy = \text{maximum.}$$

$$\therefore \frac{dx}{dy} = -\frac{x+2y}{2x+y} = -\frac{c}{b}, \text{ or } y = \frac{(2c-b)x}{2b-c}.$$

$$\therefore x^2 = \frac{a^2 (2b-c)^2}{b^2 - bc + c^2}; \text{ and } x = \pm \frac{a(2b-c)}{\sqrt{(b^2 - bc + c^2)}}, \quad y = \pm \frac{a(2c-b)}{\sqrt{(b^2 - bc + c^2)}}.$$

$$\therefore bx + cy = 2a\sqrt{(b^2 - bc + c^2)} = 2a\sqrt{\frac{b^3 + c^3}{b+c}} \text{ is a maximum.}$$

Also solved by F. L. Griffin and S. G. Barton.

329. Proposed by C. N. SCHMALL, 604 East 5th Street, New York City.

Between the quantities  $a$  and  $b$  there are inserted  $n$  arithmetical and  $n$  harmonical means, and a series of  $n$  terms is formed by dividing each arithmetical by the corresponding harmonical mean. Show that the sum of the series is,  $n \left[ 1 + \frac{n+2}{n+1} \cdot \frac{(a-b)^2}{6ab} \right]$ .

Solution by HOWARD C. FEEMSTER, A. B., Professor of Mathematics, York College, York, Neb., and S. G. BARTON, Ph. D., Clarkson School of Technology, Potsdam, N. Y.

The  $n$  arithmetic means between  $a$  and  $b$  are:

$$(1) \quad \frac{b+na}{n+1}, \quad \frac{2b+(n-1)a}{n+1}, \quad \dots, \quad \frac{rb+(n-r+1)a}{n+1}, \quad \dots$$

The  $n$  harmonic means between  $a$  and  $b$  are:

$$(2) \quad \frac{ab(n+1)}{nb+a}, \quad \frac{ab(n+1)}{(n-1)b+2a}, \quad \dots, \quad \frac{ab(n+1)}{(n-r+1)b+(r-1)a}, \quad \dots$$

Dividing the terms of (1) by the corresponding terms of (2),

$$\frac{(b+na)(a+nb)}{ab(n+1)^2}, \quad \frac{[2b+(n-1)a][(n-1)b+2a]}{ab(n+1)^2}, \quad \dots,$$